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UNITED STATES

DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

REGION I

PORTLAND, OREGON

TUOLUMNE RIVER

FLOW STUDY

Canyon Power Project

California

A Report By The U. S. Fish and Wildlife Service
On A Field Study Conducted In Cooperation With
The National Park Service, The U. S. Forest Service,
And The California Department Of Fish And Game

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Approved: AUG 23 1976

By R. Kahler Martinson

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Regional Director

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View of Hetch Hetchy Valley before inundation, ca. 1915

INTRODUCTION

The so-called Raker Act (38 Stat. 242), approved by the President of the United States on December 19, 1913, granted to the City and County of San Francisco rights-of-way to certain lands in Yosemite National Park and Stanislaus National Forest for construction, operation and maintenance of facilities necessary to regulate and convey waters of the Tuolumne River for the purposes of domestic water supply and electric power generation. Staged construction of water supply and hydroelectric facilities, collectively termed the Hetch Hetchy Project, took place over the next several decades. The Hetch Hetchy Project is operated by the San Francisco Public Utilities Commission. 1/

Among the first project facilities built were O'Shaughnessy Dam, at the lower end of Hetch Hetchy Valley in Yosemite National Park, and a diversion dam and tunnel entrance, at a point 12.1 miles downstream (known as Early Intake) in Stanislaus National Forest. The Tuolumne River and contiguous uplands between Hetch Hetchy and Early Intake also lie within the boundaries of Yosemite National Park and Stanislaus National Forest. From 1925 to 1967, water released from Hetch Hetchy Reservoir was diverted from the river at Early Intake and conveyed by Mountain Tunnel 20 miles to a powerhouse on Moccasin Creek, a tributary of the Tuolumne. Additional facilities were constructed to convey water for municipal supply from Moccasin to San Francisco, a distance of about 120 miles.

Initial project plans approved pursuant to the Raker Act called for eventual diversion of river flow at O'Shaughnessy Dam and conveyance by tunnel on the south side of the Tuolumne to a powerhouse at Early Intake (Canyon Power Project). Subsequent engineering studies demonstrated the superiority of a tunnel alignment on the north side of the river and, accordingly in 1958, San Francisco filed an application with the Department of the Interior for change of location of tunnel right-of-way from the south to north side of the river. Inasmuch as diversion at O'Shaughnessy Dam would substantially alter the flow regime of the Tuolumne between the dam and Early Intake, and in view of the fact that the environmental consequences of the alteration had not been adequately considered when the rights-of-way across Federal lands were initially granted, the Secretary of the Interior stipulated (Appendix A) in his approval of the change in location of the tunnel right-of-way that water be released from Hetch Hetchy Reservoir into the Tuolumne River in accordance with the following schedule:

1/ Although Hetch Hetchy is a hydroelectric project affecting lands of the United States, it is not subject to regulation by the Federal Power Commission (Sec. 29 of the Federal Power Act).

May 1 through September 15 - Minimum of 75 cubic feet/second

September 16 through April 30 - Minimum of 35 cubic feet/second

The Secretary further stipulated that the National Park Service, the U.S. Forest Service, and the U.S. Fish and Wildlife Service would jointly conduct, with voluntary participation by the applicant and the California Department of Fish and Game, a 2-year study of the Tuolumne River between O'Shaughnessy Dam and Early Intake to determine the adequacy of the prescribed flows for fish life, recreational use, and esthetic considerations.

Under the terms of the authorization granted by the Secretary of the Interior, the designated flows may be changed on the basis of recommendations developed from the 2-year interagency study. The recommended flows become a part of the conditions under which the San Francisco Public Utilities Commission must operate the Canyon Power Project, unless an objection is filed within 30 days of notification by the Secretary of any revised flows. In the event of objection, the Commission is entitled to a hearing before a special hearing officer who will develop a finding of fact for the Secretary's consideration before a final determination is made.

The Canyon power project was completed in 1967 and the interagency field study began the following year.

This report describes the interagency study conducted pursuant to the Secretary's order and presents a recommended release schedule to protect the fishery, recreational use, and esthetics of the affected reach of the Tuolumne River. The U.S. Fish and Wildlife Service and the California Department of Fish and Game jointly conducted the field portion of the fishery study. The U.S. Forest Service and the National Park Service carried out that part of the study pertaining to recreation and esthetics. All agencies participated in the analysis of data collected. Numerous interagency meetings, often including representatives of the San Francisco Public Utilities Commission, were held during the course of the investigation to discuss study procedures and results. The Commission cooperated throughout the study by providing experimental flows and technical assistance and, in accordance with Section 9(r) of the Raker Act, by reimbursing the study agencies for a substantial part of expenses incurred.

DESCRIPTION OF RIVER INCLUDING THE STUDY AREA

The Tuolumne River originates at the base of a glacier on the west slope of 13,000-foot high Mount Lyell in Yosemite National Park. The Tuolumne flows westward from its origin for a distance of 158 miles to join the San Joaquin River near the city of Modesto, draining an area of about 2,000 square miles. Numerous small tributaries augment the flow of the mainstem as it courses downward from its beginnings across Tuolumne Meadow and over the falls and cascades of the "Grand Canyon of the Tuolumne." Beyond, and still within the national park, the river enters 8-mile long Hetch Hetchy Valley where, since construction of O'Shaughnessy Dam in 1923, the valley floor has lain submerged beneath Hetch Hetchy Reservoir (Figure 1). For the next 2 miles, the river drops from pool to pool over cascades and rapids until the gentler gradients of Poopenaut Valley are reached (Figure 2). The river then enters Tuolumne Gorge where for a distance of about 2.5 miles its flow is confined by sheer granite walls (Figure 3). Emerging from the gorge, the river drops over Preston Falls into Preston Meadow (Figure 4), then into Indian Meadow, and on to Early Intake where, prior to 1967, much of its flow was diverted into Mountain Tunnel (Figure 5). Water is still diverted from the Tuolumne at Early Intake, but this is now accomplished by means of a bypass tunnel and conduit connecting Kirkwood Powerhouse and Mountain Tunnel. Below Early Intake, the Tuolumne continues westward to be joined by Cherry Creek, South Fork, Clavey River and other major tributaries before entering the reservoir pool impounded by Don Pedro Dam. From Don Pedro, the Tuolumne completes its exit of the foothills, traverses the western floor of the Central Valley, and enters the northward flowing San Joaquin.

Fishery resources of the Tuolumne River are significant. Rainbow, brown, brook, and golden trout inhabit the upper coldwater reaches of the river. The range of rainbows and browns extends as far downstream as Don Pedro Reservoir. Largemouth and smallmouth bass, bluegill, warmouth, white catfish and other warmwater fishes abound in the lower foothill and valley reaches of the Tuolumne. The Tuolumne River once supported annual runs of chinook salmon ranging upward of 100,000 fish. Modern runs have declined because of the adverse effects of gravel extraction, dams, and water diversions. The 1974 spawning run of adult chinook salmon was estimated at only 1,000 fish. The California Department of Fish and Game has indicated that increased diversions may result in the complete elimination of salmon from the Tuolumne (see appended letter).

Wildlife species frequenting the Tuolumne drainage include black-tailed deer, California mule deer, black bear, black-tailed jackrabbit, gray squirrel, coyote, beaver, mink, muskrat, raccoon, striped skunk, California quail, mountain quail, blue grouse, band-tailed pigeon, mourning dove and dipper. A mountain lion and a southern bald eagle, the latter an endangered species, were sighted by field crews during the study.

The natural values of the Tuolumne River between Hetch Hetchy Reservoir and Don Pedro Reservoir are of sufficient magnitude that the segment was designated in 1970, pursuant to Section 5(d) of the Wild and Scenic Rivers Act (Public Law 90-542), as a potential addition to the National Wild and Scenic Rivers System. In 1975, the Act (Section 5a) was amended (Public Law 93-621) to add the Tuolumne from its headwaters to Don Pedro Reservoir to the active study list. The study was initiated in August 1975 and is to be completed and submitted to the President and to Congress by October 2, 1979.

The study area reported on herein is the 12.1-mile reach of the Tuolumne between O'Shaughnessy Dam and Early Intake (Plate I). As noted above, its principal physiographical features are Poopenaut Valley, Tuolumne Gorge, and Preston Meadow. This reach of the river lies at the bottom of a canyon averaging about 1,500 feet in depth. The river drops at a rate of about 100 feet per mile as it traverses the granitic floor of the canyon. Its overall aspect is that of a series of long pools separated by comparatively short riffles, rapids, and cascades. Sand beaches occur at a few places where the stream gradient is slight. Vegetative cover on the upper slopes of the canyon is relatively sparse because of limiting climatic and edaphic conditions. The bottom of the canyon supports a more dense stand of vegetation. Principal woody species are ponderosa pine, incense cedar, California black oak, California buckeye, willow, alder, ceanothus, birchleaf mahogany, manzanita, elderberry, wild grape, and poison oak.

The natural flow regime of the river was drastically altered following the construction of O'Shaughnessy Dam and Hetch Hetchy Reservoir. Further alteration resulted from the installation of Canyon Tunnel which can divert in excess of 850 cubic feet per second (cfs) from the reservoir. During the decade preceding the beginning of Canyon Tunnel diversion in 1967, average daily river flow below the dam rarely fell below 200 cfs. Since 1967, reservoir releases have generally been near or below 75 cfs except when flood spills or other non-fish related considerations required greater releases.

Access to the study area is difficult because of the steepness of the terrain. Road access is available at either end, but all access between is by means of foot trails extending down the south slope from the public road connecting Early Intake and O'Shaughnessy Dam. The trail leading from the road near Poopenaut Pass to the river below, in Yosemite National Park, descends over 1,300 feet. A well-defined foot trail follows the river from Kirkwood powerhouse, at Early Intake, upstream a distance of 4 miles to Preston Falls.

Figure 1. O'Shaughnessey Dam and Hetch Hetchy Reservoir.

Figure 2. Poopenaut Valley.

Figure 3. Tuolumne River from Mather Pool northeast to Tuolumne Gorge.

Figure 4. Preston Meadow and Preston Falls.

Figure 5. Overhead view of Early Intake Pool. Early Intake Diversion Dam and Mountain Tunnel entrance on left; Robert C. Kirkwood Powerhouse and Penstock (from Canyon Tunnel) on right. After passing through the turbines, Canyon Tunnel Water is conveyed by tunnel and conduit around Early Intake Pool to Mountain Tunnel.

METHODS AND RESULTS

Stream Transects

In August and September 1968 and in July 1970, stream transect measurements were made at five representative riffle areas in the 12.1-mile study reach to determine the amount of habitat available to trout and other aquatic organisms at flows approximating 35, 50, 75, 100, 125, 150, 175 and 200 cfs. The riffle areas selected for transect study (Figures 6, 7, 8, 9 and 10) ranged in length from about 150 to 300 feet and, at a flow of 75 cfs, averaged nearly 70 feet in width. Wetted riffle area and useable riffle area were determined for each of the experimental flows. Wetted riffle area is a measurement of the riffle water surface from bank to bank. Useable riffle area is defined as that part of the riffle over which water flows at depths greater than 0.3 feet, and at velocities ranging from 0.5 to 3.5 feet per second measured 0.3 feet from the streambed. Where these physical parameters are met optimum conditions occur for trout spawning and rearing of young, as well as for streambed production of aquatic organisms on which trout feed.

At each station six parallel and generally equidistant cross-channel lines or transects were laid out and staked on the bank for future reference. Depth and velocity measurements were taken at 2-foot intervals along each transect, marked by an engineer's steel tape stretched from bank to bank (Figure 10a). The linear distance from water's edge to water's edge was also noted. Data collected for each transect line were considered to be representative of streambed conditions for a distance of 12½ feet upstream and 12½ feet downstream from the line. The breadth of any emergent rock occurring along the transect line was recorded so that its transect length could be deducted from the overall length of the transect line before computing the wetted area for the transect (i.e., distance in feet from water's edge to water's edge, minus emergent rocks, multiplied by 25 feet). Total wetted area, unuseable wetted area, and useable wetted area figures for each of the transect stations were compiled by summing the corresponding figures for the six transect lines comprising the station. Consolidated data for all transect stations are presented in Table 1 and displayed graphically in Figure 11.

From Table 1 it may be seen that the amount of wetted area at the transect stations did not change greatly throughout the range of test flows. At the lowest flow (36 cfs) which was only 17 percent of the highest flow (211 cfs), more than 70 percent of the streambed was still within the wetted area. The area which could be used by trout, on the other hand, underwent a marked reduction as the volume of flow ranged downward. At the lowest flow (36 cfs), over 60 percent of the riffle area classified as useable at the highest flow (211 cfs) had been lost. The rates of decline in the amount of wetted area and the amount of useable area did not differ greatly between 211 and 152 cfs. At flows

below 152 cfs, however, useable area dropped off more rapidly than wetted area, especially at flows below 75 cfs. Figures 12a through 12f show the appearance of the riffle area at Transect Station No. 1 at flows ranging from 35 to 150 cfs. The contrast in stream aspect at these extremes is especially striking in Poopenaut Valley where the stream gradient is low (Figures 13a and 13b).

Table 1. Useable and unuseable riffle area at various flows (5 transect stations)

TEST FLOW	WETTED AREA	UNUSEABLE AREA[1/]	USEABLE AREA	
cfs	square ft.	square ft.	square ft.	% decline
211	72,236	22,666	49,570	0
190	70,344	22,778	47,566	4.0
152	66,853	22,727	44,126	11.0
125	63,952	23,556	40,396	18.5
98	61,275	25,518	35,757	27.9
75	58,280	27,010	31,270	36.9
54	54,939	29,990	24,949	49.7
36	51,499	31,989	19,510	60.6

1/ That part of the wetted area unavailable to trout because of shallowness (less than 0.3 feet) or unsuitable rate of flow (less than 0.5 or greater than 3.5 feet per second).

Figure 6. Transect Station No. 1.

Figure 7. Transect Station No. 2.

Figure 8. Transect Station No. 3.

Figure 9. Transect Station No. 4.

Figure 10. Transect Station No. 5.

Figure 10a. Measuring flow velocity with sonic current meter.

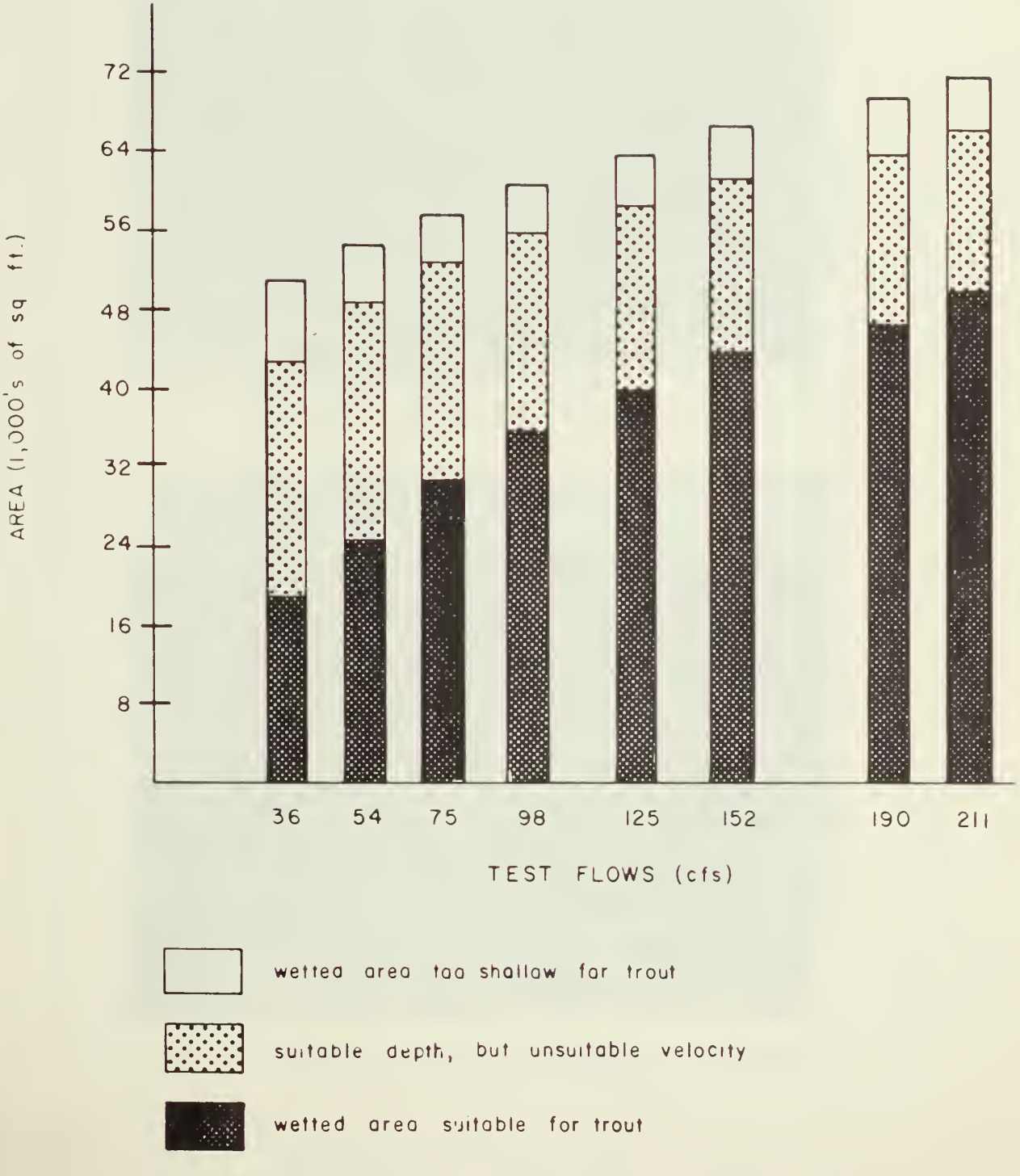


Figure 11. Composition of wetted area at various flows (5 transect stations)

Figure 12a. Transect Station No. 1 (35 cfs).

Figure 12b. Transect Station No. 1 (50 cfs).

Figure 12c. Transect Station No. 1 (75 cfs).

Figure 12d. Transect Station No. 1 (100 cfs).

Figure 12e. Transect Station No. 1 (125 cfs).

Figure 12f. Transect Station No. 1 (150 cfs).

Figure 13a. Poopenaut Valley, flow at 35 cfs.

Figure 13b. Poopenaut Valley, flow at 150 cfs.

Stream Temperatures

Cool water released from Hetch Hetchy Reservoir during the summer months is perforce warmed by solar radiation and ambient air temperature as the water flows down the 12.1-mile study reach. Manipulation of reservoir releases in 1968, 1970, and 1971 permitted the collection of data concerning the interrelationship of flow volume, air temperature, and stream temperature.

Thermograph stations to record water temperature were established at three points: 1 mile below O'Shaughnessy Dam; the upper end of Preston Meadow; and ½-mile upstream from Early Intake. At each station, a Ryan Model D-45 thermograph (Ryan Instruments, Inc.) was anchored at least 3 feet below the water surface by means of a heavy chain encircling a large rock. Daily air temperature readings used in this analysis were recorded by San Francisco at its Early Intake weather station. Both air and water temperature are given in degrees Fahrenheit.

1968 - From July 1 to August 9 (39 days), the release from Hetch Hetchy Reservoir was held at, or slightly below, the 75 cfs minimum level prescribed for the summer period. On August 9, the release was rapidly increased over a 36-hour period to about 350 cfs, then as suddenly reduced over the next 36 hours to 150 cfs. The release was held at the 150 cfs level for 4 days then reduced in a stepwise fashion by increments of 25 cfs over the remaining 14 days of the 1968 monitoring period. The release was held for 3 days at the 125 cfs level and again at the 100 cfs level, then lowered to 75 cfs where it remained relatively constant until September 16, the beginning of the prescribed minimum winter flow (35 cfs). Flow reduction between steps was generally accomplished over a period of 48 hours. The release pattern is shown in Figure 14a.

During the first part of the test period (July 1-August 9), when the Hetch Hetchy release was near 75 cfs, the maximum daily water temperatures at O'Shaughnessy, Preston Meadow, and Early Intake ranged respectively from 54^{o} to 56^{o}, 66^{o} to 69^{o}, and 70^{o} to 75^{o}F. The average of the maximum daily water temperatures at Early Intake was 73^{o}. Thus, the water gradually warmed as it flowed down the river and at the end of the study reach was about 18 degrees above its temperature at the beginning. By the time water released from Hetch Hetchy had traversed two-thirds of the study area, it had already reached temperatures marginal to the well-being of trout (68^{o}); by the time it reached Early Intake, temperatures suitable for trout were clearly exceeded. Air temperatures during this period, recorded at Early Intake, were seasonal and relatively stable (median daily range of 72^{o} to 85^{o}, with an average of 79^{o}). Median daily air temperature was derived by halving the sum of the daily maximum and minimum temperatures.

In response to the sudden increase in the Hetch Hetchy release from 75 to 350 cfs during August 9 and 10, the maximum daily water temperature at Early Intake fell a full 10 degrees (from 71° to 61°). Although the thermograph at Preston Meadow was not in operation at this time, it can probably be assumed that a comparable reduction in stream temperature occurred there in response to the sudden flow increase. Predictably, stream temperature at O'Shaughnessy gaging station did not drop significantly. The air temperature record for Early Intake shows a striking downward trend in median daily values (from 77° to 54°) beginning on August 11 and extending over the next 10 days. However, it is believed that the reduction in water temperature at Early Intake was due principally to increased flow because the median daily air temperature had dropped less than 5 degrees when the lowest water temperature was recorded at Early Intake.

During the final phase of the 1968 test period, when water was released from Hetch Hetchy in a descending stepwise fashion from 150 to 75 cfs, maximum daily water temperatures at all stations showed a general increase, reaching the levels prevailing during the first part of the test period when the release was stabilized near 75 cfs. A pronounced departure from the overall upward trend in water temperature occurred midway through the final phase. Between August 17 and 21, when the flow release was being reduced from 150 to 125 cfs and held at 125 cfs for 3 days, maximum daily water temperatures at Preston Meadow and Early Intake dropped approximately 5 degrees. An inspection of air and water temperature data for this brief period showed a nearly perfect coincidence of peaks and troughs. From August 18 to 21, median daily air temperature dropped 14 degrees.

1970 - Stream temperature data were compiled for two periods in 1970: May 1-31 and July 1-September 13. The thermograph stations were inaccessible for much of June because of high flows. During May, releases from Hetch Hetchy varied from 1,000 to 2,000 cfs except for the first 2 days of the month when the release was 85 cfs. Maximum daily water temperature on May 1 and 2 at O'Shaughnessy Dam was 47°. Maximum daily water temperatures at Preston Meadow and Early Intake held at about 56° and 58°, respectively, until May 3 when they rapidly declined to a low of 49° on May 6 in response to the greatly increased release from Hetch Hetchy. Maximum daily water temperatures at Preston Meadow and Early Intake gradually increased as the month progressed, but did not exceed 53°. Median daily air temperature increased during the month, varying between 55° and 74°, except for a sudden drop to 46° on May 6 coincident with the lowest stream temperatures recorded at Preston Meadow and Early Intake.

The July 1 to September 13 segment of the 1970 test program (Figure 14b) was continuous except for an 8-day lapse between July 9 and 17. During the first 9 days of July, the maximum daily water temperature at Early Intake soared from 55° on July 1 to 70° on July 6, then fell to 56° on July 9. During this period the release from Hetch Hetchy fluctuated from about 1,600 cfs on July 1 down to 85 cfs on July 3-5, then back up to over 1,000 cfs by July 7. Median daily air temperature at Early Intake ranged from 67° to 82° and generally followed a distribution pattern corresponding to that of daily water temperatures. The severe changes in flow release were made for reasons of project operation.

Beginning on July 17, releases from Hetch Hetchy were reduced stepwise from flows in excess of 210 cfs to 35 cfs over a period of 48 days. Releases were held from 3 to 6 days at the following levels: 210, 185, 165, 140, 115, 85, and 45 cfs. The 35 cfs level, reached on September 3, was monitored for 10 days. As in 1968, reduction of flow between steps was generally accomplished in 2 days. As expected, the maximum daily water temperature at Early Intake followed an upward trend as Hetch Hetchy releases were reduced. The lowest maximum temperature (62°) was recorded on July 17. Prior to that date, flow had been in excess of 210 cfs. The highest daily maximum temperature (72°) was recorded on September 12. From August 18 to the end of the monitoring period, when flows were at or below 115 cfs, the maximum daily water temperature (with the exception of 3 days) reached or exceeded 68°. Median daily air temperature during the July 17 to September 13 period ranged between 65 and 81 degrees except for 2 days when the median temperature dropped to about 60°.

1971 - Releases of 150 cfs and 125 cfs were monitored for 6 days each from August 9 to 22 in 1971 to further quantify stream temperatures in that flow range. The highest maximum water temperature recorded at Early Intake during the 150 cfs phase was 67°. During that time, median daily air temperatures ranged from 78° to 86°. When flow was reduced to 125 cfs, a maximum water temperature of 68° was reached at Early Intake. Median air temperature during the latter phase varied from 78° to 87°. Beginning on August 22, the Hetch Hetchy release was stepped up over a period of 2 days to 240 cfs where it was held for 4 days. Water temperatures at Early Intake subsequently dropped to a daily maximum of 60°.

An inspection of maximum and minimum daily water temperatures for 1968, 1970, and 1971 revealed that the magnitude of daily variation was directly related to volume of flow. At 75 cfs, the daily fluctuation at Early Intake was typically about 5 degrees Fahrenheit, but on occasion was as great as 9 degrees. In the 125-150 cfs range, daily fluctuation was typically 2-3 degrees. At flows above 200 cfs, fluctuation seldom exceeded 2 degrees.

Examination of scales removed in August and September of 1968 from 49 brown trout showed an unusual condition in 11 cases. It was noted that annuli, or growth checks, had begun to form at the outer margin of the scales. The formation of growth checks is induced by environmental stress and typically occurs during the winter months when growth of the fish slows or ceases as a result of diminished food supply. The fact that some trout were forming annuli in late summer suggests that the adverse environmental condition responsible may have been above-optimum stream temperatures.

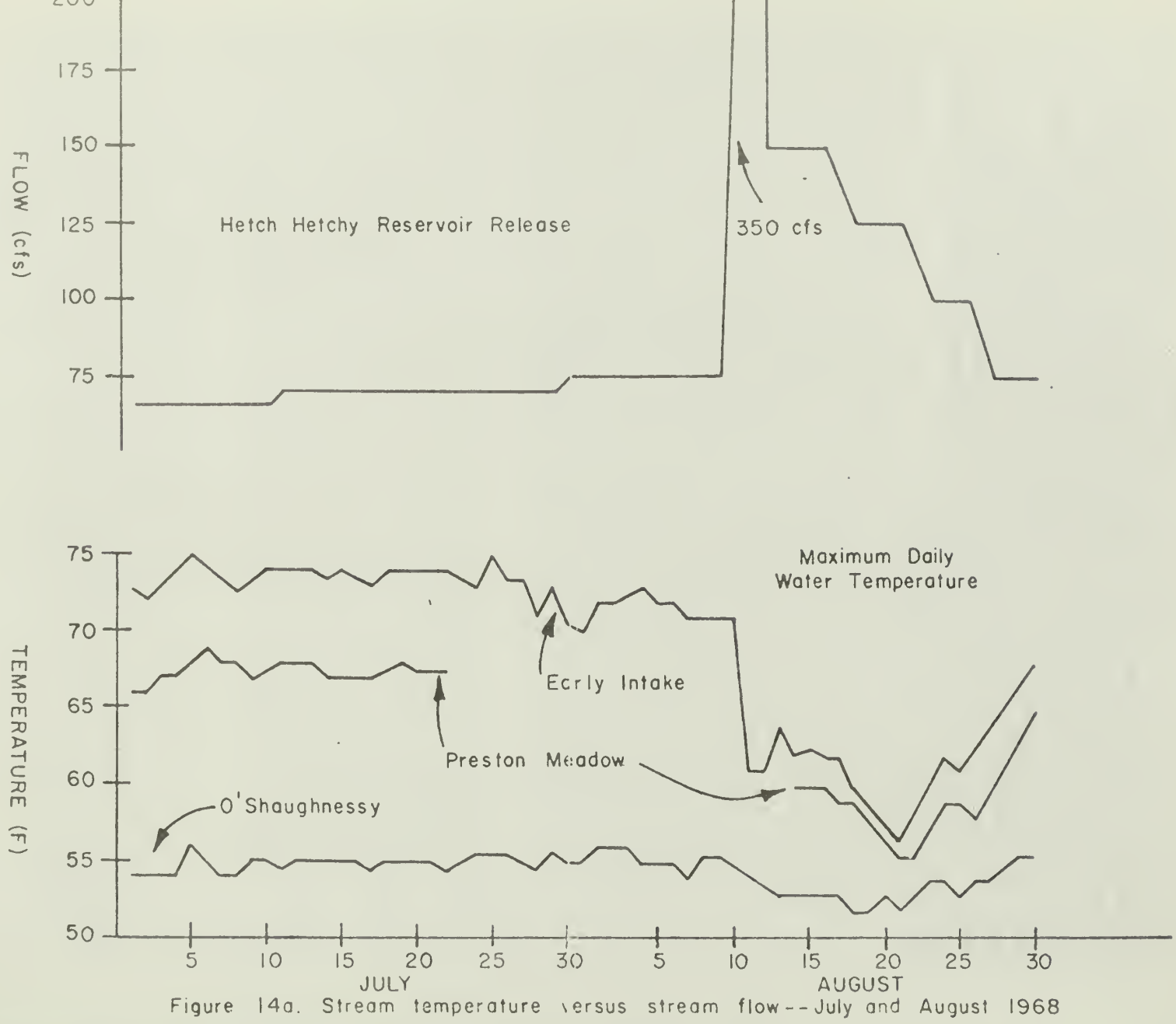


Figure 14a. Stream temperature versus stream flow--July and August 1968

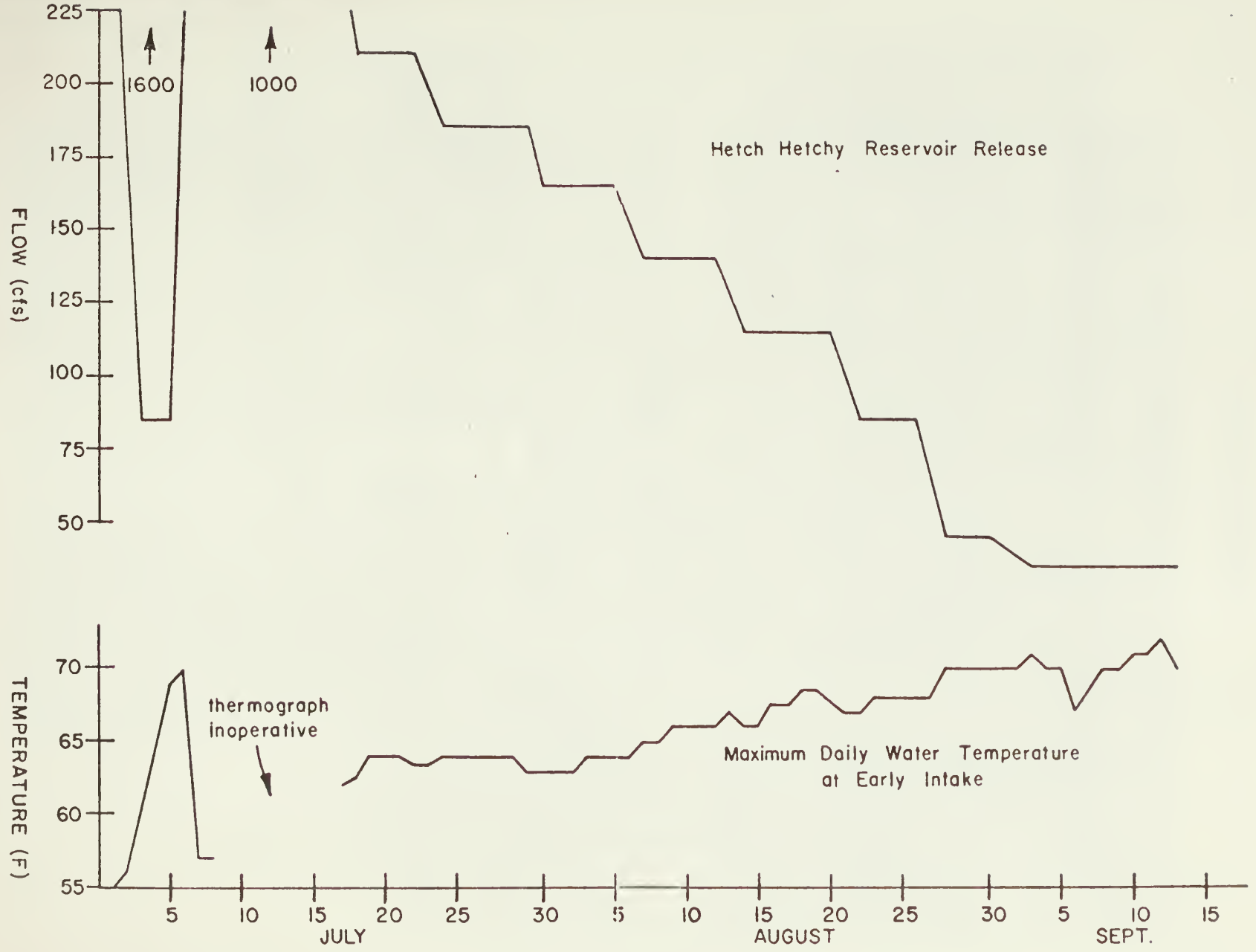


Figure 14b. Stream temperature versus stream flow--July, August and early September 1970

Streamflow Records

Flow records contained in water supply papers published by the U.S. Geological Survey were studied to assess the operational impact of Hetch Hetchy Reservoir and Canyon Tunnel on the flow regime of the 12.1-mile study reach. From 1910 to 1915, streamflow was measured at the site of O'Shaughnessy Dam. Since 1915, flow has been recorded at a gaging station 1 mile downstream from the dam.

An examination of the record shows that the average daily flow was 999 cfs for the 57 years preceding the diversion of water from Hetch Hetchy Reservoir into Canyon Tunnel. During that period, streamflow ranged from a low of 1.3 cfs in November 1923 (following closure of O'Shaughnessy Dam) to a high of 12,900 cfs on June 1, 1943. The overall effect of Hetch Hetchy Reservoir on downstream flow, prior to Canyon Tunnel diversion in 1967, was a reduction in the magnitude of spring runoff flows and an augmentation of naturally occurring low flows in late summer and early fall. Inspection of the record for the decade preceding Canyon Tunnel diversion shows that streamflow at the gaging station rarely fell below 200 cfs. Average daily flow during the 10-year period dropped below 200 cfs on only 25 occasions and then no lower than 188 cfs (September 1961).

Since 1967, when the Canyon Project was completed, with a diversion capacity somewhat in excess of 850 cfs, water has been released from Hetch Hetchy Reservoir to the Tuolumne River in conformance with the schedule stipulated by the Secretary of the Interior: 75 cfs May 1-September 15, and 35 cfs September 16-April 30. In general, releases have been greater than the required minimums only when the storage capacity of the reservoir was exceeded. The record indicates that on three occasions since 1967 reservoir releases to the river were shut-off for periods of 1, 2, and 7 days. A visible consequence of the overall reduction in flow since 1967 is death of riparian vegetation along the banks of the former flow line and the encroachment of willows and alders into parts of the streambed no longer inundated.

Water Quality

Over a 36-hour period during September 10-12, 1968, the U.S. Geological Survey monitored selected water quality parameters near each end of the study reach. Water samples were collected hourly and measured for specific conductance, dissolved oxygen, temperature, pH, and total alkalinity. Percent saturation of dissolved oxygen was calculated from the observed data. The measurements were taken when riverflow was about 75 cfs and 3 days before flow was reduced to 35 cfs in conformance with the prescribed minimum flow schedule. The values obtained are generally consistent with those characterizing the coldwater stream habitat. The low readings for total alkalinity indicate relatively infertile water in terms of dissolved nutrients. It is to be noted that a maximum water temperature of 75.2°F. was recorded at the Early Intake station.

Table 2

Water Quality Values
At Two Tuolumne River Locations
September 10-12, 1968

	UPPER[1/]		LOWER[2/]	
	range	average	range	average
Specific conductance (micromhos/cm)	9.0 - 22.0	11.1	13.0 - 18.0	15.6
Total alkalinity (mg/l HCO_3)	4.0 - 8.5	6.2	5.0 - 6.5	5.7
Temperature (°F.)	51.4 - 55.4	52.7	65.1 - 75.2	69.1
pH (units)	5.3 - 6.6	6.0	6.4 - 6.9	6.7
Dissolved oxygen (mg/l)	8.3 - 9.9	9.3	7.3 - 8.3	7.8
Oxygen saturation (%)	85.0 - 104.0	-	85.0 -100.0	-

1/ 1 mile downstream from O'Shaughnessy Dam.
2/ ½ mile upstream from Early Intake.

Streambed Food Production

In 1968, 1969, and 1970, bottom-dwelling fishfood organisms were collected from the riffles at the transect stations by means of a "Surber sampler" (Figure 15). Sampling was generally accomplished on a monthly basis from late spring through early fall. The sampling yielded a typical variety of aquatic insect forms (predominately of the Orders TRICHOPTERA, PLECOPTERA, EPHEMEROPTERA, MEGALOPTERA, and DIPTERA), but showed the streambed to be relatively unproductive of fishfood organisms. Analysis by volumetric displacement of the organisms recovered from 100 samples gave an average value of only 0.14 cubic centimeter per square foot of streambed. A riffle is considered to be of average or better productivity if values in excess of 1 cubic centimeter per square foot are obtained.

The paucity of streambed organisms is probably due to the infertility of the water and to the devastation that attends sizeable and sudden changes in volume of flow. It was noted on several occasions during the course of the study that habitat supporting benthic organisms was dewatered when releases from Hetch Hetchy Reservoir were reduced for operational reasons. Channel scouring, caused by rapid increase in flow, is also destructive to streambed life.

An examination of stomach contents from 34 brown and rainbow trout collected during May 1970 revealed the importance of terrestrial insects (HYMENOPTERA and COLEOPTERA) at that time of the year, in addition to the aquatic insects noted above.

Figure 15. Collecting streambed organisms.

Fish Population

In September 1970, when flow was 35 cfs, rotenone was applied to the river at four locations (Plate I) for the purpose of gathering data from which to estimate the number of trout inhabiting the study reach (Figures 16, 17, and 18). The combined length of the sampling areas was nearly one-half mile. They were identified with respect to nearby landmarks, i.e., "old gage station," "upper Poopenaut," "Tuolumne Gorge," and "transect 5." In advance of rotenone application, ¼-inch mesh nets were placed across the stream at the upstream and downstream limits of the sampling area. At the upper and lower sampling areas, known numbers of fin-clipped, hatchery-reared rainbow trout (4 to 14 inches) were planted 1 day before rotenoning so that the percent recovery of wild trout might be assessed. As the current carried the rotenone from the sampling area it was detoxified with potassium permanganate. All wild trout recovered were identified by species, measured (fork length), and weighed.

The number of wild rainbow trout (*Salmo gairdneri* Richardson) and brown trout (*S. trutta* Linneaus) recovered from the four sampling areas is presented in Table 3. At the old gage station sampling site, about 70 percent of the marked, hatchery-reared trout planted prior to rotenone application were recovered. At Transect 5, about 80 percent of the planted trout were recovered. By extrapolation, taking into account the indicated recovery rates, it was estimated that the 12.1-mile study reach supported about 8,000 wild trout of catchable size (6.5 inches and over) near the end of the 1970 recreation season (Table 4).

As shown by Table 3, brown trout predominated among the fish recovered from the rotenone-treated stream segments. Catchable-size brown trout outnumbered rainbow trout at the old gage station area by a ratio of nearly 5 to 1. The ratio was somewhat more balanced (about 2 to 1) farther downstream at the upper Poopenaut and Tuolumne Gorge sampling areas, and was near unity at transect 5. The preponderance of brown trout toward the upper end of the study area may be due to the different spawning habits of the two species. At the upper end of the area in spring, when rainbows normally spawn, water temperatures are low and flow uneven because of variable reservoir releases. In the fall, when browns spawn, the water at the upper end is less cool and the reservoir release pattern has stabilized.

An inspection of length frequency data for the collected specimens (Table 5) indicates that young trout averaged from 5 to 9 cm (2 to 4 inches) fork length near the end of their first summer. Rainbow and brown trout inhabiting the study reach appear to reach harvestable size late in their second summer or early in their third summer.

Non-salmonid fishes were found at two of the sampling areas. Suckers (*Catostomus sp.*) and riffle sculpin (*Cottus sp.*) were abundant at the transect 5 area and are believed to be well established throughout the lower four miles of the study reach from Early Intake to Preston Falls. The falls undoubtedly prevents their movement farther upstream. A few minnows (*Cyprinidae*) were captured at the old gage station sampling area. Minnows of the same kind are abundant in Hetch Hetchy Reservoir, 1 mile upstream.

Figure 16. Applying rotenone to stream section.

Figure 17. Block net at lower end of rotenone - treated stream section.

Figure 18. Measuring brown trout.

Table 3

Wild Rainbow and Brown Trout Collected
at Four Tuolumne River Locations
September 1970

Location and Species	Miles of Stream	Trout Recovered	Fork Length (inches) Under 6.5	6.5 plus	Pounds (6.5 inches plu
Old gage station	.15				
Rainbow		11	1	10	2.6
Brown		188	140	48	10.4
Upper Poopenaut	.13				
Rainbow		55	43	12	2.4
Brown		201	172	29	5.5
Tuolumne Gorge	.08				
Rainbow		85	66	19	4.0
Brown		161	121	40	13.4
Transect 5	.06				
Rainbow		69	53	16	3.0
Brown		65	52	13	5.0
TOTAL	.42				
Rainbow		220	163	57	12.0
Brown		615	485	130	34.3

Table 4

Estimated Population of Catchable-Size Trout
in Tuolumne River Study Reach
September 1970

Stream Segment	Length (miles)	Trout (6.5 inches plus) Rainbow	Brown	Total
Hetch Hetchy to Poopenaut Valley	1.8	168	828	996
Poopenaut Valley to Tuolumne Gorge	1.7	221	546	767
Tuolumne Gorge	2.6	780	1,625	2,405
Tuolumne Gorge to Preston Falls	2.0	634	892	1,526
Preston Falls to Early Intake	4.0	1,333	1,067	2,400
TOTAL	12.1	3,136	4,958	8,094

Table 5

Length Frequency Distribution of Wild Trout Collected
at Four Tuolumne River Locations
September 1970

SUBCATCHABLE (0 - 6.5 inches)			CATCHABLE (6.5 inches plus)		
Fork Length (cm)	Rainbow	Brown	Fork Length (cm)	Rainbow	Brown
1			17	7	24
2			18	10	14
3			19	6	12
4	1		20	9	10
5	30	2	21	10	19
6	52	52	22	6	15
7	36	153	23	3	8
8	2	156	24	5	9
9	1	62	25	1	5
10		6	26		3
11		1	27		3
12	2	2	28		3
13	6	3	29		1
14	12	8	30		
15	10	18	31		1
16	11	22	37		1
			42		1

Use of the study reach by fishermen and other recreationists was assessed during the 1970 recreation season (May 1-November 15). Visitor registration boxes were placed at the Early Intake trailhead and at the Powerhouse Road, Mather Camp, and Poopenaut Valley trailheads by the Forest Service and the Park Service. In addition, a creel census, covering about 15 percent of the total recreation days, was conducted by the Fish and Wildlife Service. Creel data were segregated by weekdays, weekend days, and holidays before extrapolation to derive use and angler-success estimates for the entire season.

Information compiled from the self-registration forms placed at trailheads, and from on-site interviews, indicated that use of the 12.1-mile study reach amounted to nearly 1,300 visitor-days during the 1970 recreation season (Table 6). Fishing was either the primary or a collateral motivation for 70 percent of the visitation. Pursuit of outdoor experiences not including fishing (e.g., hiking and camping) accounted for the remaining visitation.

On the basis of registration forms and creel census data, it is estimated that 1,815 trout were harvested from the study reach during the 1970 recreation season. This and other estimates pertaining to fisherman success are presented in Table 7. The total catch was comprised of about equal proportions of rainbow and brown trout (55 percent rainbow, 45 percent brown).

From Table 7 it is seen that angler success in Tuolumne Gorge (1.25 trout per hour) was 2 to 3 times greater than that in other sections of the study reach. The use and success figures for Tuolumne Gorge may be questioned because they were derived by extrapolating information gained by interviewing only two fishermen. However, these fishermen accounted for 16 hours of fishing over a 2-day period during which time they creeled at least 20 trout. It is reasonable to conclude that angler success was greater in the gorge because of its difficult access.

Most camping along the study reach within Yosemite National Park takes place in the vicinity of the gaging station one mile below O'Shaughnessy Dam and in Poopenaut Valley. In Stanislaus National Forest, campers use the small flats at Mather Pool, Preston Meadow, Indian Meadow (near transect station 5), and Preston Meadow trailhead above Kirkwood power-house. All of these camping areas are presently undeveloped. Future development for recreationists, as envisioned by the Park Service and the Forest Service, would be guided by consideration of the potential that the study reach has for addition to the National Wild and Scenic Rivers System. Development will likely be limited to minor improvement of existing trails and installation of sanitation and campfire facilities at selected campgrounds. The Forest Service anticipates that use of the study reach within Stanislaus National Park will exceed 3,200 daily visits by 1990. Assuming that use of the study reach within Yosemite National Park increases at the same rate, it may be anticipated that use of the upper 6-mile segment will approach 2,700 daily visits by 1990.

In 1968 and 1970, Forest Service personnel photographed and made other observations of the river at flows of 1,600, 300, 250, 200, 150, 125, 100, 75, 50, and 35 cfs at several locations in Stanislaus National Forest. A report by the Forest Service ("Tuolumne River Flow Study, Stanislaus National Forest," October 25, 1972) containing numerous 8 x 10 inch color photographs of the river at the above flows is on file at the Ecological Services Office, U.S. Fish and Wildlife Service, Sacramento. Based on the study of the recreation and esthetic characteristics of the river within the study area at various flows, the Forest Service considers that the summer (May 15-September 15) flow should be no less than 150 cfs and that the winter (September 16-May 14) flow should be no less than 75 cfs. Because high flows are unfavorable for camping and fishing, the Forest Service believes that flows between May 20 and September 1 should not exceed 350 cfs. Winter flows should not exceed 700 cfs, in the interest of minimizing channel scour and erosion and preventing bank overflow.

Except for dry years, the National Park Service advocates a minimum summer flow of 200 cfs from May 1 to June 30 and 150 cfs from July 1 to September 30. A summer flow of this character would simulate the historical flow regime. A minimum winter (October 1 to April 30) flow of 75 cfs is proposed by the Park Service. In dry years, the Park Service has proposed a minimum summer flow of 150 cfs from May 1 to September 15 and a minimum winter flow of 75 cfs from September 16 to April 30.

Table 6

Visitor Use of
the Tuolumne River between
O'Shaughnessy Dam and Early Intake
May 1 to November 15, 1970

River Section	Length (miles)	Fisherman-Days	Other Recreation-Days	Total Visitor-Days
O'Shaughnessy Dam to Poopenaut Valley	1.8	224	113	337
Poopenaut Valley to Tuolumne Gorge	1.7	165	58	223
Tuolumne Gorge	2.6	15	0	15
Tuolumne Gorge to Early Intake	6.0	495	207	702
TOTAL	12.1	899	378	1,277

Table 7

Estimated Harvest and Angler Success
Tuolumne River between
O'Shaughnessy Dam and Early Intake
May 1 to November 15, 1970

River Section	Trout Caught	Angler-Hours	Catch Rate (trout/hour)	Catch Rate (trout/mile)
O'Shaughnessy Dam to Poopenaut Valley	294	701	0.42	163
Poopenaut Valley to Tuolumne Gorge	304	533	0.57	179
Tuolumne Gorge	75	60	1.25	28
Tuolumne Gorge to Early Intake	1,142	1,774	0.64	191
TOTAL or AVERAGE	1,815	3,068	0.59	150

DISCUSSION

On the basis of streamflow records, 200 cfs may be taken as the minimum flow characteristic of the study reach during the decade preceding the diversion of water through Canyon Tunnel. Since 1967, when tunnel diversion began, the minimum flow has been near 35 cfs in winter and 75 cfs in summer. The stream transect data show that at the reduced flows there is a substantial reduction in riffle area--a critically important component of trout habitat. When flow was reduced from 211 cfs to 75 cfs, it was found that the loss of useable trout habitat at the transect stations amounted to 40 percent. At 35 cfs, the loss reached 60 percent. The importance of the riffles to trout in the study reach is accentuated by the fact that the stream, under the best of flows, has a preponderance of pool area over riffle area. Hence, any reduction in useable riffle area during the spawning and rearing seasons immediately affects the stream's capability to sustain its population of trout. Additionally, the temperature monitoring data demonstrate that the presently required minimum summer flow (75 cfs) is inadequate for the maintenance of suitable stream temperatures throughout the study reach. It is apparent that a summer flow in excess of 100 cfs is essential for maintenance of coldwater fish habitat in the lower portion of the study reach. As noted earlier, the U.S. Forest Service and the National Park Service believe that a minimum winter flow of 75 cfs and a minimum summer flow of 150 cfs (NPS advocates 200 cfs for early summer in wet years) must be provided if recreational and esthetic values are to be protected. Thus, the conservation agencies, including the California Department of Fish and Game, are in agreement that the present minimum flow schedule should be more than doubled. A schedule of minimum flows embracing all of the considerations noted above would appear as follows:

Period	*cfs*
January 1 - April 30	75
May 1 - June 30	200
July 1 - September 30	150
October 1 - December 31	75

After considering the schedule, officials of the San Francisco Public Utilities Commission proposed an alternate schedule of minimum reservoir releases for the consideration of the conservation agencies (Appendix C). The Commission's proposal consists of four series of release patterns, each series keyed to actual precipitation and runoff conditions in a given year. The conservation agencies have examined the Commission's proposal, but conclude that the schedule of releases set forth above must be observed in all years if the fishery, recreational, and esthetic values of the study reach are to be adequately protected.

Stipulation No. 7 of "STIPULATIONS FOR RELOCATION AND AMENDMENT OF RIGHTS OF WAY FOR TUNNEL AQUEDUCT..." (Appendix A) states:

> Changes in magnitude of water releases into the Tuolumne River from O'Shaughnessy Dam shall be gradual and minimal and shall be restricted to those having a fairly constant rate of change producing not more than double nor less than one-half the previous release over a one-hour period, except as may be required by emergency operations resulting from mechanical failure or other conditions beyond the control of the Applicant.

The requirement, as written, allows for substantial changes in the volume of reservoir release over a short period (e.g., from 1,000 cfs up to 2,000 cfs or down to 500 cfs in 1 hour). A sudden and extreme change in the volume of water released from the reservoir has a devastating effect on fishlife and fishfood organisms inhabiting the study reach. A rapid elevation of flow volume scours the streambed and erodes the streambanks. Aquatic insect forms comprising the benthic community are displaced, the water is made turbid, and the downstream reaches are subjected to sedimentation that fills the gravel interstices. The consequences of scouring flows are especially damaging during the trout spawning, egg incubation, and rearing periods. Conversely, a sudden drop in the volume of flow adversely affects the stream biota by desiccating insect forms attached to gravels as well as trout redds. Rapid flow changes in either direction, of course, seriously impact the recreational-use and esthetic values of the stream.

The ecological damages and the hazard to recreationists resulting from rapid change in volume of release would be less severe if the time period specified in the stipulation were changed to read: "over a 4-hour period." Additionally, it is believed that when riverflow is in the range of 75 to 200 cfs, which will generally be the case under the schedule proposed, the rate of change should not exceed 50 cfs over a 4-hour period.

As previously noted, the Forest Service believes that reservoir releases during the summer (May 20 to September 1) should not exceed 350 cfs and that releases during the balance of the year should be held below 700 cfs. If releases did not exceed these maxima, interference with camping, fishing, and other recreational uses of the river would be reduced and the adverse effects of channel scour, erosion, and bank overflow minimized. It is recognized that the storage capacity of the reservoir as well as the vagaries of weather and other exigencies prevent perfect observance of such a requirement. However, it is believed that these release limits should be imposed as a project-operating goal.

There is no requirement under present rights-of-way that the conservation agencies be provided with a periodic report of reservoir releases. We believe that such a report, specifying the amount of the release on a daily basis, should be submitted by the San Francisco Public Utilities Commission to the conservation agencies on a monthly basis. The report should also contain an explanation of any circumstances preventing compliance with the minimum flow requirement for the period reported on. In addition, the agencies should be advised at least 1 week in advance of any anticipated noncompliance so that field observation may be planned, if desired.

Only operating experience can demonstrate the adequacy of the reservoir releases discussed herein in terms of volume and seasonal distribution. For that reason, the conservation agencies believe that followup studies should be carried out subsequent to implementation of the revised schedule of minimum releases. Such studies would be generally comparable to those already described, but could involve an assessment of flows other than those examined thus far. In addition, future studies would consider the need for fish passage facilities at Early Intake Dam. The dam constitutes a barrier to the upstream migration of trout during the spawning season; however, the significance of the blockage from the standpoint of maintaining the native fishery has not been determined. Any followup studies by the conservation agencies, for which reimbursement under Section 9(r) of the Raker Act is sought, would be undertaken pursuant to proposals submitted through administrative channels for approval by the Secretary of the Interior.

A requirement that water released at O'Shaughnessy Dam for fish remain in the Tuolumne River beyond Early Intake Dam is set forth in "STIPULATIONS FOR AMENDMENT OF RIGHTS-OF-WAY FOR CANYON POWER PLANT...," dated February 9, 1965, (Appendix B). Item 3 of those stipulations reads:

> The amendment applied for is also subject to provision that water diversions by applicant below Early Intake Dam do not decrease the magnitude of water releases from O'Shaughnessy Dam for fish, and provided these releases in addition to accretional runoff be permitted to enter and continue in the Tuolumne River below Early Intake.

Continuation of the foregoing stipulation in conjunction with the increased Hetch Hetchy releases will improve river conditions to Don Pedro Reservoir. Presently, the Tuolumne River below Cherry Creek confluence is subject to widely fluctuating flows resulting from the operation of Holm Powerhouse on Cherry Creek. The fishery and recreational values of the Tuolumne River to Don Pedro are significantly reduced when flows drop coincident with routine curtailment of power generation.

CONCLUSIONS

On the basis of a study conducted by the U.S. Fish and Wildlife Service in conjunction with the U.S. Forest Service, the National Park Service, and the California Department of Fish and Game pursuant to a stipulation 1/ contained in the rights-of-way governing operation of Canyon Power Project, it is concluded that the present schedule of minimum releases (ranging from 35 to 75 cfs) from Hetch Hetchy Reservoir to the Tuolumne River at O'Shaughnessy Dam is inadequate for the protection of downstream fishery, recreational, and esthetic values. It is believed that a schedule of minimum reservoir releases ranging from 75 to 200 cfs (as set forth in the DISCUSSION section of this report), together with certain related measures, would provide an acceptable level of protection for the natural values associated with the 12.1-mile reach of the river traversing lands within Yosemite National Park and Stanislaus National Forest between O'Shaughnessy Dam and Early Intake and the 1.5-mile reach of river from Early Intake to Cherry Creek confluence. Recommendations are made for implementation of a revised schedule of minimum releases and related conservation measures by amendment and supplementation of the federally granted rights-of-way under which the San Francisco Public Utilities Commission operates the Canyon Power Project.

1/ Appendix A: STIPULATIONS FOR RELOCATION AND AMENDMENT OF RIGHTS-OF-WAY FOR TUNNEL AQUEDUCT, STEEL PENSTOCK, POWER PLANT SITE, SPOIL AREAS AND ACCESS ROADS AS APPROVED PURSUANT TO MAPS FILED APRIL 10, 1914, JULY 3, 1916, AND DECEMBER 13, 1916, IN UNITED STATES LAND OFFICE AT SACRAMENTO, CALIFORNIA, MAP R-527; REVISION NO. 1, FILED OCTOBER 2, 1958. (Amended Sacramento Serial No. 010130).

RECOMMENDATIONS

To protect the fishery, recreational, and esthetic values of the Tuolumne River downstream from O'Shaughnessy Dam (Hetch Hetchy Reservoir), the U.S. Fish and Wildlife Service (with the concurrence of the U.S. Forest Service, the National Park Service, and the California Department of Fish and Game) recommends that the rights-of-way under which the San Francisco Public Utilities Commission operates its Canyon Power Project be amended or supplemented, as appropriate, to provide for the following measures:

1. That the minimum amounts of water released from Hetch Hetchy Reservoir to the Tuolumne River at O'Shaughnessy Dam be in accordance with the following schedule:

Period	*cfs*
January 1 - April 30	75
May 1 - June 30	200
July 1 - September 30	150
October 1 - December 31	75

2. That the allowable rate of change in the magnitude of water releases from Hetch Hetchy Reservoir to the river at O'Shaughnessy Dam be changed from the present stipulation of "...not more than double nor less than one-half the previous release over a one-hour period..." to "not more than double nor less than one-half the previous release over a 4-hour period except when the previous release is 200 cfs or less, in which case the rate of change shall not exceed 50 cfs over a 4-hour period."

3. That insofar as the storage capacity of Hetch Hetchy Reservoir and emergency situations allow, the amount of water released to the river at O'Shaughnessy Dam shall not exceed 350 cfs from May 20 through August 31 and 700 cfs from September 1 through May 19.

4. That the San Francisco Public Utilities Commission provide the appropriate field offices of the U.S. Forest Service, the National Park Service, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game with periodic reports of releases from Hetch Hetchy Reservoir to the Tuolumne River at O'Shaughnessy Dam. The reports should (1) be furnished on a monthly basis by the 10th work-day of the month following that reported on, (2) indicate the magnitude of the release at any given time during the report period, and (3) contain an explanation of any circumstances preventing compliance with the schedule of minimum reservoir releases specified in Recommendation No. 1.

5. That the San Francisco Public Utilities Commission notify the appropriate field offices of the U.S. Forest Service, the National Park Service, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game at least 7 days in advance of any anticipated noncompliance with the schedule of minimum reservoir releases specified in Recommendation No. 1.

6. That the San Francisco Public Utilities Commission agree to reimburse the U.S. Fish and Wildlife Service for the cost of any followup studies it may undertake in cooperation with the California Department of Fish and Game, the National Park Service, and the U.S. Forest Service, or that may be undertaken by the California Department of Fish and Game in cooperation with the above named agencies. Such followup studies would be implemented on the basis of study plans approved by the Secretary of the Interior and would have as their purpose (1) a determination of the adequacy of the revised reservoir release schedule for protection of the fishery, recreational, and esthetic values of the Tuolumne River from O'Shaughnessy Dam to the confluence of Cherry Creek, and (2) an assessment of the need for fish passage facilities at Early Intake Dam.

APPENDIX

A. Letter of April 27, 1961, from Secretary of the Interior, Washington, D.C., to City Attorney, San Francisco, California, with enclosed "STIPULATIONS FOR RELOCATION AND AMENDMENT OF RIGHTS-OF-WAY FOR TUNNEL AQUEDUCT..."

B. Letter of February 9, 1965, from Assistant Manager, Adjudication Branch, Bureau of Land Management, Sacramento, California, to General Manager, Power and Utilities Engineering Bureau, Public Utilities Commission, San Francisco, California, with enclosed "STIPULATIONS FOR AMENDMENT OF RIGHTS-OF-WAY FOR CANYON POWER PROJECT..."

C. Letter of January 23, 1973, from General Manager, Hetch Hetchy Water and Power, Public Utilities Commission, San Francisco, California, to Field Supervisor, Division of River Basin Studies, U.S. Fish and Wildlife Service, Sacramento, California

D. Letters of concurrence from U.S. Forest Service, dated August 13 and September 26, 1975

E. Letter of concurrence from National Park Service, dated August 27, 1975

F. Letter of concurrence from California Department of Fish and Game, dated May 18, 1976

COPY

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
Washington 25, D.C.

Certified Mail
Return Receipt Requested

April 27, 1961

Dear Mr. Holm:

This refers to the appeal of the City and County of San Francisco (hereinafter sometimes referred to as the City or the Grantee) from the decision of the Land Office at Sacramento, California, dated July 9, 1959, which required the City to execute certain stipulations (relating among other things, to minimum releases of water) as a condition to the granting of its application for a change of location of a right-of-way in the Stanislaus National Forest and the Yosemite National Park. The City appealed to the Director, Bureau of Land Management. The Secretary of the Interior assumed direct jurisdiction over this appeal.

The United States Forest Service, the National Park Service, the Fish and Wildlife Service and the California Department of Fish and Game have recommended revised stipulations as to minimum releases of water into the Tuolumne River from O'Shaughnessy Dam (Hetch Hetchy Reservoir). The revised stipulations would require minimum releases of 75 cfs for the period May 1 through September 15 and 35 cfs for the period September 16 through April 30. In addition, the stipulations call for a study to determine whether increases should be required in these minima with final decision as to any recommended increases to be made by the Secretary after notice and hearing.

In accordance with the provisions of the Raker Act, 38 Stat. 242 (1913), the Department of Agriculture has indicated approval of the new right-of-way location, insofar as it relates to the national forest lands.

I have concluded that the City's application should be granted, subject to conditions hereinafter referred to. My reasons follow.

This case is another chapter in the long history of the City's Hetch Hetchy developments under the Raker Act. Specifically, it concerns the City's proposed Canyon power project. The principal features consist of a tunnel about 12 miles long generally following the course of the Tuolumne River from O'Shaughnessy Dam to Early Intake and a power plant at Early Intake with a planned installed capacity of 66,000 kw. For about one-half its length the tunnel would be located in Yosemite National Park. The balance of the tunnel and the power plant itself will be constructed in Stanislaus National Forest.

The existing right-of-way was approved and amended in 1914 and 1917, respectively, pursuant to the Raker Act. This original right-of-way location follows a meandering course on the south side of the Tuolumne River. By its current application, the City seeks to relocate the route of the tunnel to a straight line on the north side of the river.

It is the fact that the City has not proceeded with the project since it received the amended right-of-way in 1917 that has given rise to the principal issue before me.

In brief, the questions for decision are whether there should be a conclusion that the City has not been diligent in prosecuting the work and, if so, whether the City's right-of-way should be declared forfeited.

The reason for the City's delay is conceded. As the Department's Special Hearing Officer found, it is because of lack of earlier need for the Canyon project's power potential due to the refusal of the electorate to approve the City's acquisition of the San Francisco electric utility operations of Pacific Gas and Electric Company.

In his finding No. 21, on diligence, the Special Hearing Officer, while attempting to preserve the issue as a legal question, concluded that the City had no responsibility for the decisions of its electorate. On the other hand, it is argued that under the charter of San Francisco the elections were essential elements in the City's decision-making process and, therefore, the decision of the electorate is perforce the decision of the City.

The Solicitor of the Department has recommended that proposed finding No. 21 be stricken since it involves conclusions of law rather than findings of fact. I accept the Solicitor's recommendation.

The Raker Act forfeiture provision is not mandatory whatever might be the conclusion as to diligence. Section 5 provides that "in the event" the Secretary determines that work has not been diligently prosecuted, the Secretary "may declare forfeited" the City's rights to the unconstructed works and refer the matter to the Attorney General, whose duty upon such referral "shall be" to commence suit to secure a judgment of forfeiture. The juxtaposition of the imperative expression "shall" with "may" in Section 5 makes it clear that the Congress intended by the latter term that the Secretary of the Interior should exercise discretion to determine whether, though lack of diligence be found, the circumstances are such as to call forth a forfeiture.

Such a reading of Section 5 accords with the ordinary meaning of the word "may", particularly when found in juxtaposition with expressions of command; it is also in accord with the traditional gravity with which the courts approach forfeitures.

A forfeiture is harsh. Before considering it, an official should be certain that the public interest can be satisfied in no other way. After most careful judgement, I have concluded that, under the terms and conditions to which the approval will be subject, the public interest can be protected. Therefore, I do not at this time and in the circumstances under which the change in location will be approved, deem it necessary to determine the question of diligence.

At the same time, I must observe in all candor that the argument that the City must take responsibility for the decisions of its electorate is a compelling one and, consequently, the grantee would have a heavy burden to overcome were the diligence question to be in issue.

I am persuaded that the north side location can be approved consistent with the public interest for the following reasons:

(1) The interests of sport fishery and recreation can be protected by requiring continuing releases of water from O'Shaughnessy Dam to maintain the Tuolumne as a live stream between the dam and Early Intake. This will be of great importance as there is no requirement for release of water to maintain a live stream under the original, south side right-of-way. With this requirement added to the stipulations, the National Park Service and the Fish and Wildlife Service, together with the Forest Service and the California Department of Fish and Game, are agreeable to approval of the change in location.

(2) The north side straight line right-of-way, with provision for weathering of rocks and spoil, and considering the location of spoil banks, is a marked improvement aesthetically over the south side route.

(3) The major incursion in Yosemite Park came with the construction of the storage facilities, that is with O'Shaughnessy Dam itself. The tunnel, if constructed in the north side location, will have but minor additional effect on Yosemite Park. On the other hand, forfeiture would have a major impact upon the City's realization of benefits from the large investment already made in constructed works and would result in total loss of the substantial money, time and effort that has been expended in connection with the Canyon project.

(4) The power plant--the principal new external feature to be added by the development--will be outside the boundaries of Yosemite Park, as will the tunnel for one-half of its length. The Federal Power Act, enacted subsequent to the

Raker Act, does not exclude the use of national forest lands for power development under proper safeguards. This suggests a less rigid approach to the policy question than would be the case were the principal impact to be on the Park.

(5) Finally, we deal here with a public not a private body.

I am cognizant of the earnestness and force of the argument that this application should be made the occasion to put an end to the City's further construction of projects under the Raker Act. As in any matter involving judgment and discretion, however, the conflicting factors must be balanced and a decision reached.

Taking collectively all the factors into account, the balance favors approval of the change in location under proper conditions as set out in the stipulations annexed hereto.

Under other circumstances and conditions, I am not prepared to say that the approval of this Department could be forthcoming. I must and shall look with jaundiced eye upon any further initiation of construction activities under the Raker Act grants. It is only the special circumstances here present and above outlined, together with the remedial stipulations, that have impelled me to conclude that the public interest does not in this instance require a present determination as to diligence or a forfeiture.

The application to change the right-of-way location is hereby conditionally approved as shown by endorsement of Map R-527, Revision 1, dated September 15, 1958, which delineates in red the amended right-of-way location, subject to the execution in quadruplicate by the proper officials of the City and County of San Francisco of the revised stipulations enclosed herewith and the filing thereof in the office of the Director, Bureau of Land Management, Washington 25, D.C., within 30 days from receipt of this letter. This conditional approval and grant is null and void if the enclosed stipulations are not executed and filed as herein required. The approval of Map R-527, Revision 1, operates, as you know, as an abandonment of all theretofore approved rights-of-way of the City and County of San Francisco situated south of the Tuolumne River from O'Shaughnessy Dam to Early Intake for a tunnel aqueduct, penstocks, power plant, etc., in the Yosemite National Park and the Stanislaus National Forest, as delineated in green on said drawing.

Sincerely yours,

(signed) STEWART L. UDALL

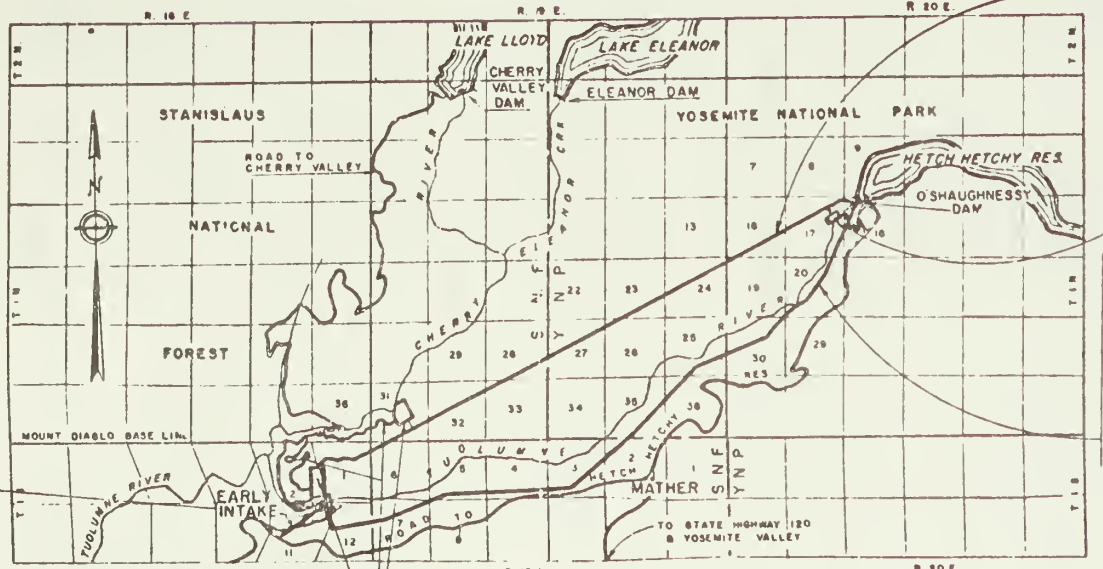
Secretary of the Interior

Dion R. Holm, Esquire
City Attorney
City Hall
San Francisco 2, California

Enclosures

100' R/W for Canyon Tunnel aqueduct requested in this application.

Spoil area and 150' R/W for access roads requested in this application.



250' R/W for electric transmission line and 250'R/W for pressure pipe & tunnel line and Power Plant Site granted to City & County of San Francisco under application Sacramento Serial Number 010130 approved by Secretary of Interior Sept 22, 1917 to be abandoned upon approval of this application.

100' R/W for tunnel aqueduct granted to City and County of San Francisco under applications Sacramento Serial Number 07187, approved by the Secretary of the Interior on June 9, 1914 and Serial No. 07259, approved by the Secretary of the Interior on July 29, 1914, subsequently amended Sept 12, 1916, Sept 22, 1917 and Nov 6, 1917, are to be amended by this application and abandoned by the City and County of San Francisco upon approval of this application

Portal Construction Site, Canyon Power Plant Site, Spoil Areas, and 150' R/W for access roads requested in this application

LOCALITY MAP

SCALE IN MILES

2 1 0 1 2 3

93216

COPY

STIPULATIONS FOR RELOCATION AND AMENDMENT OF RIGHTS-OF-WAY FOR TUNNEL AQUEDUCT, STEEL PENSTOCK, POWER PLANT SITE, SPOIL AREAS AND ACCESS ROADS AS APPROVED PURSUANT TO MAPS FILED APRIL 10, 1914, JULY 3, 1916 AND DECEMBER 13, 1916 IN UNITED STATES LAND OFFICE AT SACRAMENTO, CALIFORNIA MAP R-527, REVISION NO. 1, FILED OCTOBER 2, 1958.

(Amended Sacramento Serial No. 010130)

Pursuant to the act of December 19, 1913 (38 Stat. 242), and in consideration of relocation and installation of its facilities and the granting to it by the United States of amended rights-of-way applied for, the City and County of San Francisco, a municipal corporation of the State of California, hereinafter referred to as Applicant, does hereby stipulate and agree and does hereby bind itself, its successors and assigns, as follows:

General

1. These stipulations apply to the right-of-way requested by Applicant across national park and national forest land as shown on that map entitled "Hetch Hetchy Water Supply. Canyon Power Project, Amended location of Tunnel Aqueduct, Steel Penstock, Power Plant Site, Spoil Areas and Access Roads. Yosemite National Park and Stanislaus National Forest, California" Drawing No. R-527 revision No. 1, signed by H. E. Lloyd, Manager and Chief Engineer, on February 17, 1958, and revised on September 15, 1958, as filed with the land office at Sacramento, California, on October 2, 1958, as an amendment to the City and County of San Francisco's previous applications for rights-of-way for tunnel aqueduct, pressure pipe, power plant site, and diversion dam site filed under Serial Numbers 07259, 09719, 010128 and 010130.

2. The Applicant shall take all reasonable precautions to avoid and prevent damage to property and resources of the United States. Applicant will pay to the United States Treasury, on demand, for all damage to the said property and resources resulting from the breaking or overflowing,

leaking or seepage, of water from the conduit and for all damage to such property and resources caused by the negligence of the Applicant, its employees, contractors or employees of contractors.

3. All containers of explosives shall be disposed of by the Applicant in such manner that they shall not be accessible to the public, livestock, or wild game.

4. The applicant will not infringe upon the rights of the public to enjoy free access to the Tuolumne River between O'Shaughnessy Dam and Early Intake.

5. The Applicant will prevent its employees, agents, and contractors from releasing debris or fines arising from excavation, deposit of spoil, mining, conveyance, refining, or washing of materials into the Tuolumne River or its tributaries.

6. The Applicant will release water to stream flow from O'Shaughnessy Dam according to the following schedule:

Period	Release from O'Shaughnessy Dam in Sec. Ft.
May 1 through September 15	Minimum of 75 cfs
September 16 through April 30	Minimum of 35 cfs

PROVIDED THAT, in addition to the releases provided for above, Applicant interposes no objection to the Government diverting not to exceed 0.5 cfs for the Federal consumptive use of water in Yosemite National Park and not to exceed 5.0 cfs for the Federal consumptive use of water in Stanislaus National Forest, all within the watershed of the branch of the Tuolumne River above Early Intake. To the extent any portion of such 5.5 cfs of water is diverted from the Tuolumne River between O'Shaughnessy Dam and Early Intake for use by the Government, the releases provided for above shall be increased to the extent of such diversions or uses. This paragraph shall not be construed to add to or to limit any rights of the Government to the use of the water of the Tuolumne River System; and

PROVIDED FURTHER, that the releases shall be measured at the existing gauging station located approximately 3/4 mile below O'Shaughnessy Dam; and

PROVIDED FURTHER, that during two years, not necessarily consecutive, each beginning April 1 and extending through March 31 of the following year, a fishery and recreational (including aesthetic) study shall be made

to determine whether or not the above schedule is adequate and, if not, to determine the magnitudes of the minimum flows required. This study shall be made jointly by the National Park Service, United States Forest Service, and the United States Fish and Wildlife Service during two years when the desired regulated minimum release can be maintained for more than half the period of May 1 through September 15, to assure sound testing for the purposes indicated. The Applicant and the California Department of Fish and Game may participate in this study, if they desire to do so. The two such years shall be selected by the Secretary of the Interior after consultation with the Secretary of Agriculture. During the course of such study the Applicant shall make such adjustments of flows as may be requested as a basis for making observations; and

PROVIDED FURTHER, that if it is found during the study that the September 16 to April 30 schedule is inadequate for the spawning of trout, a modified schedule of releases between 35 cfs and 75 cfs may be recommended for all or part of March and April; and

PROVIDED FURTHER, that at the conclusion of the aforesaid two years of study and based upon such study, the agencies participating in the study shall make recommendations to the Secretary of the Interior as to the required flows. Such recommendations shall become part of these conditions, unless the Applicant, within 30 days from receipt of notice of the recommendations, shall file with the Secretary of the Interior its objections thereto. In such event, at its request, the Applicant shall be afforded a hearing regarding these objections before a special hearing officer who will render proposed findings of fact. The Secretary, after considering the proposed findings of fact and the record, shall determine what additional flows, if any, shall be required over those specified above.

7. Changes in magnitude of water releases into the Tuolumne River from O'Shaughnessy Dam shall be gradual and minimal and shall be restricted to those having a fairly constant rate of change producing not more than double nor less than one-half the previous release over a one-hour period, except as may be required by emergency operations resulting from mechanical failure or other conditions beyond the control of the Applicant.

As to Yosemite National Park

8. The Applicant shall take all reasonable precautions to prevent forest fires and shall assist the Superintendent of Yosemite National Park to extinguish forest fires in the vicinity of any tract which may be used hereunder, and in the preservation of good order within the metes and bounds of the area. Applicant will reimburse the National Park Service for fire suppression costs due to any fires resulting from operations of the Applicant. The cutting or destruction of vegetation shall be held to a minimum. All slash and debris resulting therefrom shall be disposed of as directed by the Superintendent.

9. The Applicant shall allow the National Park Service, without charge, to construct or permit to be constructed in, through or across the land covered by said right-of-way, roads, trails, conduits and other means of transportation or communication not inconsistent with the enjoyment of said right-of-way by the Applicant.

10. The Applicant shall take adequate measures, as directed and approved by the Superintendent of Yosemite National Park, to arrest and prevent soil erosion on the lands covered hereby and shall so utilize such lands as not to contribute to erosion on adjoining lands.

11. The boundaries of the spoil area immediately below O'Shaughnessy Dam are to be adjusted as designated by the Superintendent of Yosemite National Park, to save the screen of trees along the river bank.

12. When required by the Superintendent, the Applicant will have the rock spoil area sprayed, to reduce its conspicuousness. The Superintendent will specify the liquid mixture to be used for this artificial weathering purpose.

13. Within one year after completion of the project, all buildings and other facilities of a temporary character erected within Yosemite National Park, not required for the continued operation and maintenance of the project, will be removed and the sites restored to as near a natural condition as possible.

14. Within one year after completion of the project, the structures on the access roads (trestles, viaducts, bridges, etc.) toward the base of the Dam will be removed and the area occupied by same will be restored to as near a natural condition as possible. All other access roads will be kept locked by the Applicant.

15. In order for the Superintendent to provide for the adequate protection of Park values during the construction and development phases of the Canyon Power Project, the Applicant will reimburse the National Park Service for the salary and expenses of one full time Park Ranger to be assigned to the Hetch Hetchy area from the beginning of construction activities until the close of the cleanup work following the completion of construction. The liability of the Applicant to reimburse the National Park Service under this stipulation will terminate at the time the Applicant has fully complied with stipulation No. 14.

16. The location, design and standard of any road or trail, and the location of any structures or other improvements to be constructed within Yosemite National Park by the Applicant in connection with the Canyon Power Project must be approved by the Superintendent of Yosemite National Park before construction is started.

17. The Applicant shall conform to all regulations now or hereafter adopted and prescribed by the Secretary of the Interior governing Yosemite National Park.

As to Stanislaus National Forest

18. The value of all timber cut or destroyed by the Applicant or its agents which is merchantable in accordance with specifications contained in timber sales current at the time of such cutting or destruction shall be paid at standard stumpage rates then in force for the Stanislaus National Forest, and all slash and debris resulting from the cutting or destruction of such timber shall be disposed of as the Officer-in-Charge may direct.

19. The Applicant will protect the scenic and aesthetic values of the right-of-way and the adjacent land including spoil areas consistent with the authorized use and as prescribed by the Forest Service.

20. The Applicant will construct access roads to standards and specifications approved by the Forest Supervisor in advance of construction.

21. The Applicant will join with the Forest Service in preparing and actively participating in a fire plan which shall set forth in detail their respective responsibilities for the prevention, control and extinguishment of fires on the project areas and on adjacent areas.

22. The Applicant will allow officers of the Forest Service free and unrestricted access to, through, and across all lands covered by said rights-of-way in the performance of their official duties, and will allow the Forest Service without charge to construct, or permit to be constructed in, through, across or under the land covered by said rights-of-way, roads, trails, conduits, ditches, and other means of transportation or communication, not inconsistent with the enjoyment of said rights-of-way by the Applicant.

23. The Applicant will locate and construct all roads and spoil areas to reduce to a minimum the disfigurement of the landscape and erosion of the soil. Such special measures to prevent erosion, as may be required by the Forest Supervisor in writing, shall be installed by the Applicant. Material from slides that occur after construction work is completed shall be disposed of by the Applicant, at locations where not destructive to or in prevention of revegetation, and in such manner as not to be susceptible to erosion or harmful to scenic values.

24. The Applicant will dispose of brush and debris as directed by the Officer-in-Charge. Any brush and debris to be burned will be disposed of in accordance with the fire plan approved by the Forest Supervisor. The Applicant will avoid damage to young growth and will fall all snags over 25 feet in height and within 100 feet of the center line of all roads.

25. The Applicant shall conform to all regulations now or hereafter adopted and prescribed by the Secretary of Agriculture governing Stanislaus National Forest.

AND FURTHER, the City and County of San Francisco agrees to observe the nondiscrimination provisions prescribed by section 301 of Executive Order 10925, dated March 6, 1961 (26 F. R. 1977), which are incorporated herein by reference, and as used therein "contractor" means the grantee of the right-of-way (Exhibit A).

IN WITNESS WHEREOF, the said City and County of San Francisco has caused this instrument to be executed in the City of San Francisco, California, this 3 day of May, 1961.

CITY AND COUNTY OF SAN FRANCISCO

C O P Y

In reply refer to:

Sacramento 010130
L:GAC

Your reference:
Hetch Hetchy Water Supply - Canyon - Cherry Power Development - Canyon Power Project
Early Intake Resvr
Bypass and Tunnel
Aqueduct

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

LAND OFFICE
4201 U.S. Courthouse and Federal Bldg.
650 Capitol Mall
Sacramento, California
95814

February 9, 1965

DECISION

City and County of San Francisco :
c/o O.L. Moore, General Manager :
Power and Utilities Engineering : Right-of-Way
Bureau :
425 Mason Street :
San Francisco, California 94101 :

Amended Location Approved

On May 26, 1964, the City and County of San Francisco filed amended right-of-way application, Sacramento 010130, pursuant to the Act of December 19, 1913 (38 Stat. 242). The right-of-way was originally approved on September 22, 1917, and amended approval granted on April 27, 1961.

The present amendment pertains to the Canyon Power Project approved by Drawing No. 527, Revision 1, for the installation of the proposed reservoir bypass. The application involves a small triangular area, 2.53 acres, to be added to the power plant site, as delineated on Drawing C-3148, in sec. 11, T. 1 S., R. 18 E., M.D.M.

The application also covered an amendment for a tunnel aqueduct right-of-way 100 feet wide as shown in red on Drawing No. C-3148. The applicant stated that they discovered that the section of the Mountain Tunnel was not covered by a Raker Act application. The City and County of San Francisco had an approved right-of-way 250 feet wide for a canal or aqueduct extending from the Early Intake Diversion Dam to the Mountain Tunnel. This right-of-way was approved by the Secretary of the Interior on September 22, 1917 under Serial No. 010130, however, the City constructed a tunnel aqueduct instead of a canal and apparently neglected to file for an amended location. Accordingly, the application, as amended for the tunnel aqueduct right-of-way 100 feet wide as shown in red on said Drawing No. C-3148, is to correct this situation.

Reports have been received from all of the interested agencies, indicating that there would be no objection to the amendment of the right-of-way subject to certain stipulations. The execution of the stipulations by the City was authorized by Resolution No. 28-65 of the Board of Supervisors of the City and County of San Francisco on January 11, 1965, and the set of stipulations were executed by Mayor John F. Shelley on January 26, 1965.

Accordingly, the application for the amendment of the right-of-way for the additional area to be added to the power plant site and the tunnel aqueduct as delineated in red on Map No. C-3148 is hereby approved. The approval is subject to all valid existing rights, and to the stipulations signed by the permittee and made a part hereof, and to the provisions, limitations, terms and conditions of the Act of December 19, 1913 (38 Stat. 242).

The request for the amended location stated that upon approval thereof that the City will abandon the right-of-way granted in 1917, which was outlined in green on Drawing No. C-3148. Relinquishment Forms 4-621a are enclosed for execution by the permittee and to be returned to this office for further appropriate action.

signed: Jesse H. Johnson

Jesse H. Johnson
Assistant Manager
Adjudication Branch

Enclosures 2
Form 4-621a

COPY

STIPULATIONS FOR AMENDMENT OF RIGHTS-OF-WAY
FOR CANYON POWER PROJECT APPROVED BY
SECRETARY OF THE INTERIOR ON MAY 26, 1961
TO ADD ADDITIONAL AREA FOR EARLY INTAKE
RESERVOIR BYPASS
MAP C-3148 FILED MAY 26, 1964 IN UNITED STATES
LAND OFFICE AT SACRAMENTO, CALIFORNIA

(Amended Sacramento Serial No. 010130)

Pursuant to the act of December 19, 1913 (38 Stat. 242), and in consideration of the granting to it by the United States of amended rights-of-way applied for, the City and County of San Francisco, a municipal corporation of the State of California, hereinafter referred to as Applicant, does hereby stipulate and agree and does hereby bind itself, it successors and assigns, as follows:

1. The amendment applied for is subject to the set of stipulations executed by Applicant on May 23, 1961 relative to application for amendment of necessary rights-of-way for its Canyon Power Project. (Amended Sacramento Serial No. 010130).

2. Construction will not start until plans for disposal of tunnel spoil and stabilization of same in place are submitted by Applicant and approved by the United States Forest Service.

3. The amendment applied for is also subject to provision that water diversions by Applicant below Early Intake Dam do not decrease the magnitude of water releases from O'Shaughnessy Dam for fish, and provided these releases in addition to accretional runoff be permitted to enter and continue in the Tuolumne River below Early Intake.

IN WITNESS WHEREOF, the said City and County of San Francisco has caused this instrument to be executed in the City of San Francisco, California, this 26th day of January, 1965.

CITY AND COUNTY OF SAN FRANCISCO

ATTEST:

/s/ John F. Shelley
Mayor

/s/ Robert J. Dolan
Clerk of the Board of Supervisors
of the City and County of San Francisco
State of California

/s/ James J. Finn
Acting General Manager of Public Utilities
City and County of San Francisco

FORM APPROVED:

Subscribed and sworn to before me

this 26th day of Jan., 1965

/s/ Thomas M. O'Connor
City Attorney
City and County of San Francisco

/s/ Martin Mongan
County Clerk
in and for the City and County of
San Francisco, State of California

By /s/ William F. Bourne
Public Utilities Counsel

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO

HETCH HETCHY WATER AND POWER

BUREAU OF LIGHT, HEAT AND POWER

855 HARRISON STREET
SAN FRANCISCO, CALIFORNIA 94107
558-3921

January 23, 1973

Subject: Hetch Hetchy Releases for Fish Enhancement and Environmental Aesthetics

. Felix Smith
eld Supervisor
S. Department of the Interior
reau of Sports Fisheries and Wildlife
vision of River Basin Studies
00 Cottage Way, Room E-2727
cramento, California 95825

tention: Mr. Jody Hoffman

ar Mr. Smith:

sed on our informal review of your preliminary report, transmitted herewith e twelve copies of "Tentative Schedule for River Releases for Fish Enhancement d Environmental Aesthetics Below O'Shaughnessy Dam". Copies are enclosed r your distribution to the various interested agencies for their review.

is tentative schedule is for your consideration as an alternative proposal Volume II of the Summary Report prepared for the City by Bechtel and sent the various agencies last November 30.

believe this schedule is fair as it is based upon the actual amount of water ailable from the watershed as indicated by precipitation and runoff. e apportionment is commensurate with available waters during wet years rough relatively dry years.

ler columns "C" and "D", the City would be receptive, as permitted by the California partment of Public Health, to recapture the river release at Early Intake by version into Mountain Tunnel.

sed upon historical data, calculations indicate that Schedule "A" would be plicable 44% of the time; Schedule "A" or "B" would be applicable 63% of the time; hedule "A" "B" or "C" would be applicable 89% of the time.

would be happy to meet with your group at your convenience to discuss this tative schedule. If you have any questions or comments regarding this schedule, the river release matter in general, feel free to contact Mr. C. T. Beggs 5-558-5924) of this office.

Very truly yours,

O. L. MOORE
General Manager

TENTATIVE SCHEDULE

River Releases For Fish Enhancement & Environmental Aesthetics Below O'Shaughnessy Dam

(Releases Varying With Precipitation or Runoff as Applicable)

PERIOD	A (Indicator / Released Flow in cfs)	B (Indicator / Released Flow in cfs)	C (Indicator / Released Flow in cfs)	D (Indicator / Released Flow in cfs)
Jan. 1 — Jan. 31	14.50 / 75	10.00 / 50	6.00 / 35	< 6.00 / 25
Feb. 1 — Feb. 28	19.00 / 75	15.00 / 50	10.00 / 35	< 10.00 / 25
Mar. 1 — Mar. 31	25.50 / 75	18.70 / 60	14.25 / 50	< 14.25 / 25
Apr. 1 — Apr. 15	29.50 / 75	23.00 / 60	18.50 / 50	< 18.50 / 25
Apr. 16 — Apr. 30	↓ / 110	↓ / 100	↓ / 50	↓ / 25
May 1 — May 15	31.00 / 150	26.00 / 125	21.00 / 75	< 21.00 / 50
May 16 — May 31	↓ / 200	↓ / 125	↓ / 100	↓ / 75
June 1 — June 30	32.35 / 200	27.00 / 125	21.75 / 100	< 21.75 / 75
July 1 — July 31	680,000 / 150	545,000 / 125	415,000 / 100	< 415,000 / 75
Aug. 1 — Aug. 31	720,000 / 150	580,000 / 125	440,000 / 100	< 440,000 / 75
Sept. 1 — Sept. 15	150	125	100	75
Sept. 16 — Sept. 30	110	100	75	50
Oct. 1 — Oct. 31	75	60	50	35
Nov. 1 — Nov. 30	75	50	35	25
Dec. 1 — Dec. 31	↓ / 75	↓ / 50	↓ / 35	↓ / 25
Total in Acre-feet	81,472	61,231	46,314	32,400

1. — Indicators from Jan. 1 to June 1 to be the precipitation measured at O'Shaughnessy since Oct. 1
From July 1 to Jan. 1, indicators are to be measured inflow into Hetch Hetchy Res'r since Oct. 1

2. — All measurements as of the first of the period.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
630 Sansome Street
San Francisco, California 94111

2700 (2600)
August 13, 1975

Mr. Felix E. Smith, Field Supervisor
Division of River Basin Studies
U.S. Fish and Wildlife Service
2800 Cottage Way, Rm E-2727
Sacramento, California 95825

Dear Mr. Smith:

We have Mr. Carson's letter of August 6 concerning review of the Canyon Power Project draft report.

The Stanislaus Forest Supervisor, Mr. Gary Cargill, will be consolidating Region 5 review comments and making our response to the draft report, directly to Regional Director Martinson as requested (with information copy to your office).

By copy of this letter we are informing Mr. Martinson of this action.

We appreciate this opportunity to review the draft report, and are pleased to have participated in the studies and work leading to it. This has been a long, complex, and highly significant activity in resource protection and management, and your office is commended for its lead role.

Sincerely,

John A. Vana

DOUGLAS R. LEISZ
Regional Forester

6200-11 (1/69)

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Stanislaus National Forest
175 South Fairview Lane, Sonora, California 95370

2750
September 26, 1975

Mr. Kayler Martinson, Regional Director
U. S. Fish and Wildlife Service
1500 N.E. Irving Street
P.O. Box 3737
Portland, Oregon 97208

Dear Mr. Martinson:

We have reviewed the Fish and Wildlife Service draft report on the Canyon Power Project. We have no additional comments and concur with the recommendations in the report.

Sincerely,

Gary E. Cargill

GARY E. CARGILL
Forest Supervisor

United States Department of the Interior
NATIONAL PARK SERVICE
WESTERN REGION
450 GOLDEN GATE AVENUE, BOX 36063
SAN FRANCISCO, CALIFORNIA 94102

EPLY REFER TO:
L7423
(WR)PSN

August 27, 1975

Mr. R. Kahler Martinson
Regional Director
U. S. Fish and Wildlife Service
P. O. Box 3737-1500 N.E. Irving Street
Portland, Oregon 97208

Dear Mr. Martinson:

The draft of the proposed report, "Tuolumne River Flow Study, Canyon Power Project (Robert C. Kirkwood Power Project), California," has been reviewed in Yosemite National Park and in the Regional Office. We concur with the report and the recommendations and conclusions it contains. We recommend that it be prepared in final form for transmittal to the Secretary of the Interior for his attention and appropriate action. If fully implemented, recommendations in this report should provide for the appropriate recreational use and perpetuation of the natural resources affected by this project.

Drafts of this report were forwarded to this Office and to Park Superintendent Leslie Arnberger, Yosemite National Park, by Acting Field Supervisor James D. Carson, Division of River Basin Studies, Sacramento, California, on August 6. To expedite the review process, typographical discrepancies and minor omissions to the report were sent directly to your Sacramento Office by Assistant Superintendent John Good. A copy of his correspondence is enclosed for your information.

We acknowledge, with appreciation, the active interest and effective direction the U. S. Fish and Wildlife Service has given to this cooperative endeavor. Many thanks to all of those who have participated in this program.

Sincerely yours,

Howard H. Chapman

Howard H. Chapman
Regional Director
Western Region

Enclosure

OLUTION BICENTENNIAL
1776-1976

TE OF CALIFORNIA—RESOURCES AGENCY

EDMUND G. BROWN JR.
RONALD REAGAN, Gove

EPARTMENT OF FISH AND GAME
16 Ninth Street
cramento, CA 95814
16) 445-3531

May 18, 1976

Mr. R. Kahler Martinson
Regional Director
U. S. Fish and Wildlife Service
P. O. Box 3737
Portland, Oregon 97208

Dear Mr. ~~Martinson~~ Kahler:

We have completed our review of the Service's draft report on the Canyon Power Project flow study and offer the following comments.

We concur with the general recommendations of the report. Our concurrence includes the recommended flow schedule (page 50) which is repeated here for convenience.

Period	CFS
January 1 - April 30	75
May 1 - June 30	200
July 1 - September 30	150
October 1 - December 31	75

This minimum flow schedule should be adhered to regardless of runoff.

It is essential that there be follow-up studies to evaluate the effectiveness of this flow schedule. We would further recommend that the water be made available as an annual block of water (83,000 a.f.) in order to facilitate post-project evaluation and management.

A problem of considerable importance is the relationship between water diversions from the Tuolumne (including present and ultimate diversions by the City of San Francisco) and the reproduction of the Tuolumne River king salmon. Studies show a strong correlation between spring outflow and the number of young salmon which survive to return as adults.

Present flows available for salmon are released from Don Pedro reservoir under stipulations set forth in Federal Power Commission license 2299. These flows run concurrent with a salmon-flow study which is to be carried out for 20 years until 1991. Upon termination of the study the Federal

Power Commission will rule on what flows will be maintained in the future.

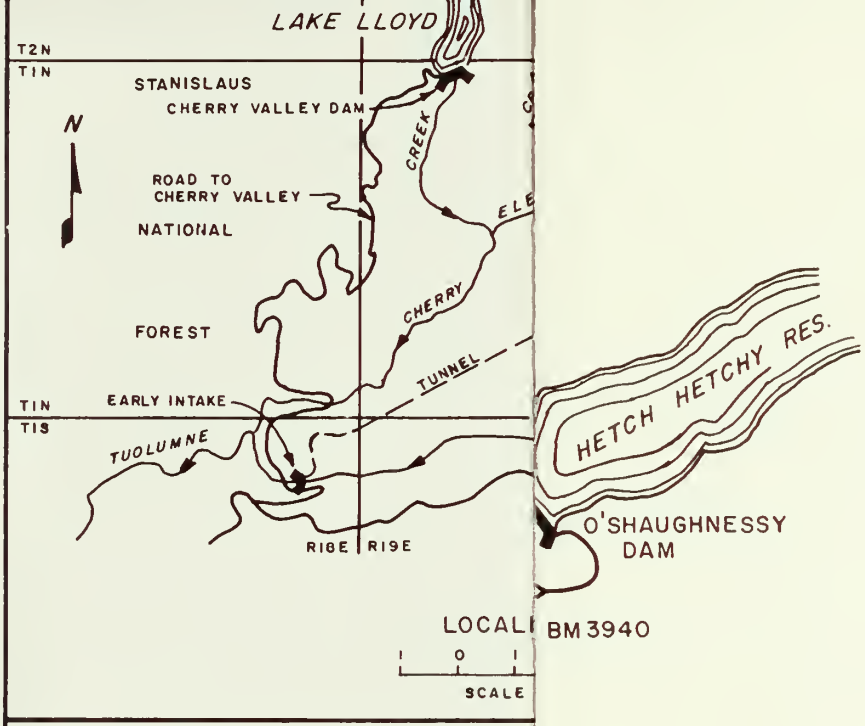
The existing flow schedules in the salmon spawning and rearing area of the river (La Grange to Waterford) are aimed at providing water during the prime spawning period (October through December). While this is important we now believe the spring outflow (March through June) is most critical. At this time the young salmon are growing and moving out of the spawning area downstream to the Delta and eventually out to the ocean.

Increasing demands on Tuolumne water by the City of San Francisco and the irrigation districts may make it impossible to maintain adequate spring flows in the river. We would recommend that the flows stipulated in the Canyon Power Project agreement be considered as "fish water" releases and be allowed to flow the entire length of the Tuolumne River. These flows are to be added to the flow releases made below the New Don Pedro Project that are stipulated in the FPC license for that project. The benefits to the fisheries from such a water release warrant support from the Secretary of Interior and the U. S. Fish and Wildlife Service.

We appreciate the opportunity to review the report and to express our views on the proposed flow schedules. Should you have any questions, please contact Mr. A. E. Naylor, Regional Manager, Region 4, 1234 East Shaw Avenue, Fresno, CA 93710, telephone (209) 222-3761.

Sincerely,

Director



LEGEND

- ROAD
- PARK - FOREST BOUNDARY
- GAGING STATION
- TUNNEL AQUEDUCT
- TRAIL
- FISH SAMPLING AREA
- TRANSECT STATION
- X BENCH MARK (EL. IN FEET)

2

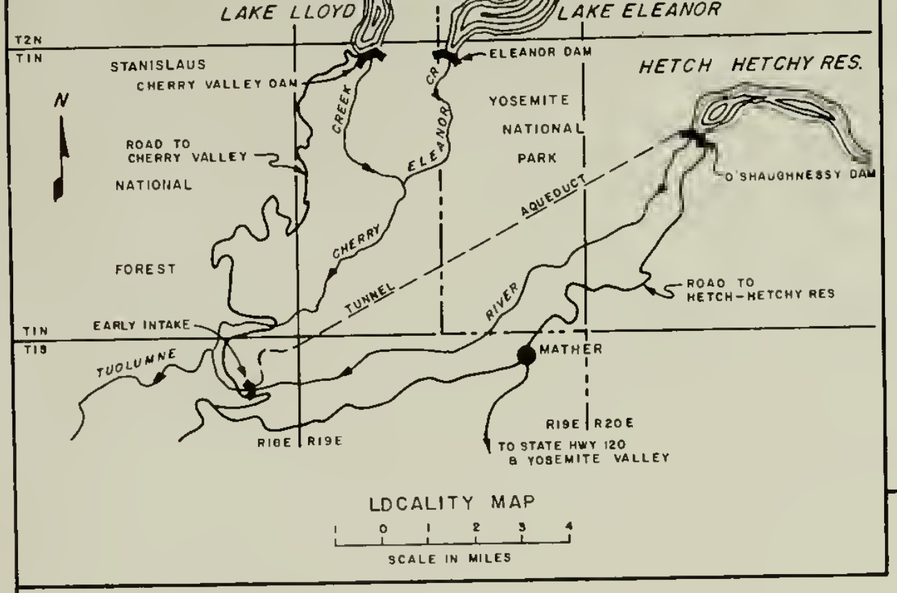
UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

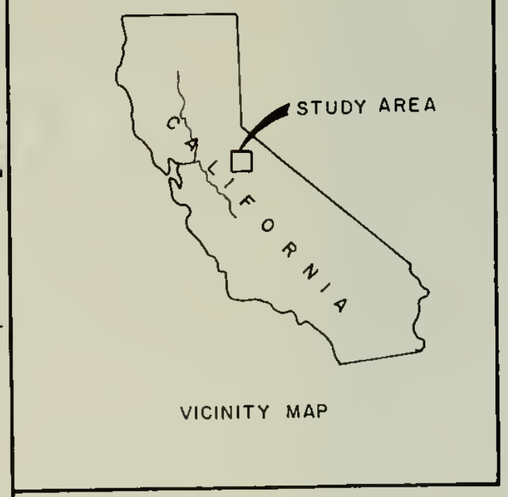
CITY AND COUNTY OF SAN FRANCISCO
CANYON POWER PROJECT
AND
FLOW STUDY AREA
TUOLUMNE RIVER

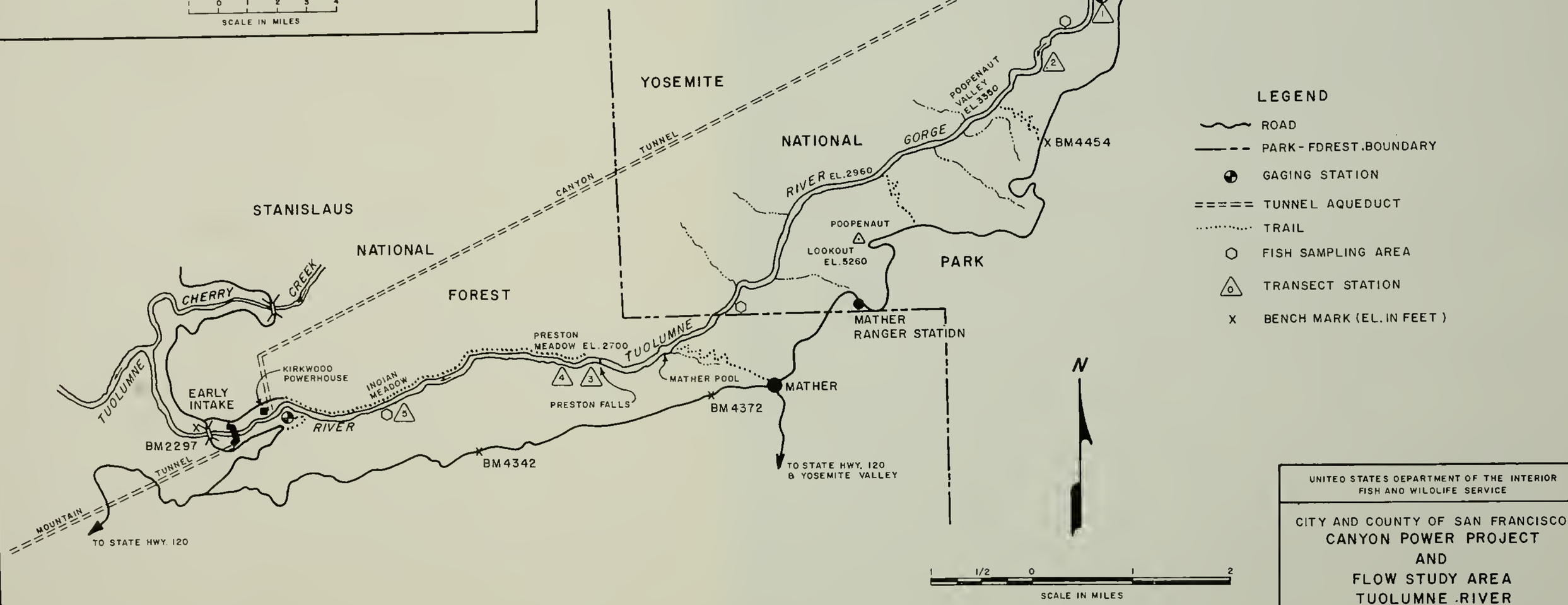
TUOLUMNE COUNTY CALIFORNIA

AUGUST 1976 PORTLAND, OREGON

PLATE I







UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

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AUGUST 1976 PORTLAND, OREGON

PLATE I